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Assembly of Horizontal Screw Conveyor in CATIA V5 using VBA

Yogesh H. Sawant¹, Akshaykumar Kadam²

¹Assistant Professor, Mechanical Department, KEC, Shelve, Pandharpur, Maharashtra, India.

²M.Tech. CAD/CAM/CAE

Abstract – The middle stage between product concept and manufacturing is modeling and assembly of components. A 3D model and assembly model of component offers user to easily understand and concrete view of component design. But during assembly making of components, user is impatient of repetitive task (i.e. assembly of same component but have different varieties) and thousands of mouse clicking (like rotation, zoom in, zoom out). Also use require the large knowledge skill of modeling software. To avoid all these problems customization of CAD software is must. In this paper automated assembly of screw conveyor is done in CATIA (CAD software) by using VBA programming language. Due to this the time required for assembly of screw conveyor is reduced up to 70-90%.

Keywords—Screw conveyor, CATIA, CAD, VBA.

1. Introduction

To transport materials from one place to another place conveyors are used. The different types of conveyor are used in industries which are classified into bulk material handling conveyor, unit handling conveyor, accumulating and non-accumulating conveyor, fixed and portable conveyors. Screw conveyors, belt conveyors, bucket elevators are bulk material handling conveyors. In chemicals, pharmaceuticals, food processing, agriculture, cements, salt, plastic, sand etc. industries use the screw conveyor for handling material. The screw conveyor design is changed according to type of material handling, capacity of conveyors, and use of different components.

CATIA (Computer Aided Tree dimensional Interactive Application) is CAD software developed by Dassault system for 3D modeling, drafting in 1977. Due to rapid development in computer technology CAD software's are widely used in many industries. In CATIA software we make parametric modeling, GUI (Graphical User Interface) for entering dimension of model. CATIA having open system for creation of macros; specification tree for keeping process information, geometry parameters, constraints; higher GUI (Graphical User Interface); easy to create part, assembly and drafting document. Due to these factors CATIA is widely used industries.

The customization of CATIA is done by using in process and out process. In process is done by using VBA, CATScript and VBScript languages. VBA has rich GUI than VBScript and CATScript. Also it has debugging facility. In this paper for automated assembly of screw conveyor VBA is used.

2. Literature review

In automotive industry press parts such as bodies, doors, frames are widely used. Today's stand in the competitive market, the development process of vehicle needs to be according to customer expectation. The critical path of entire development process is die design. Lin B. T. et al [1] developed an automated design system for drawing dies. They made a system structure for automated drawing die. It

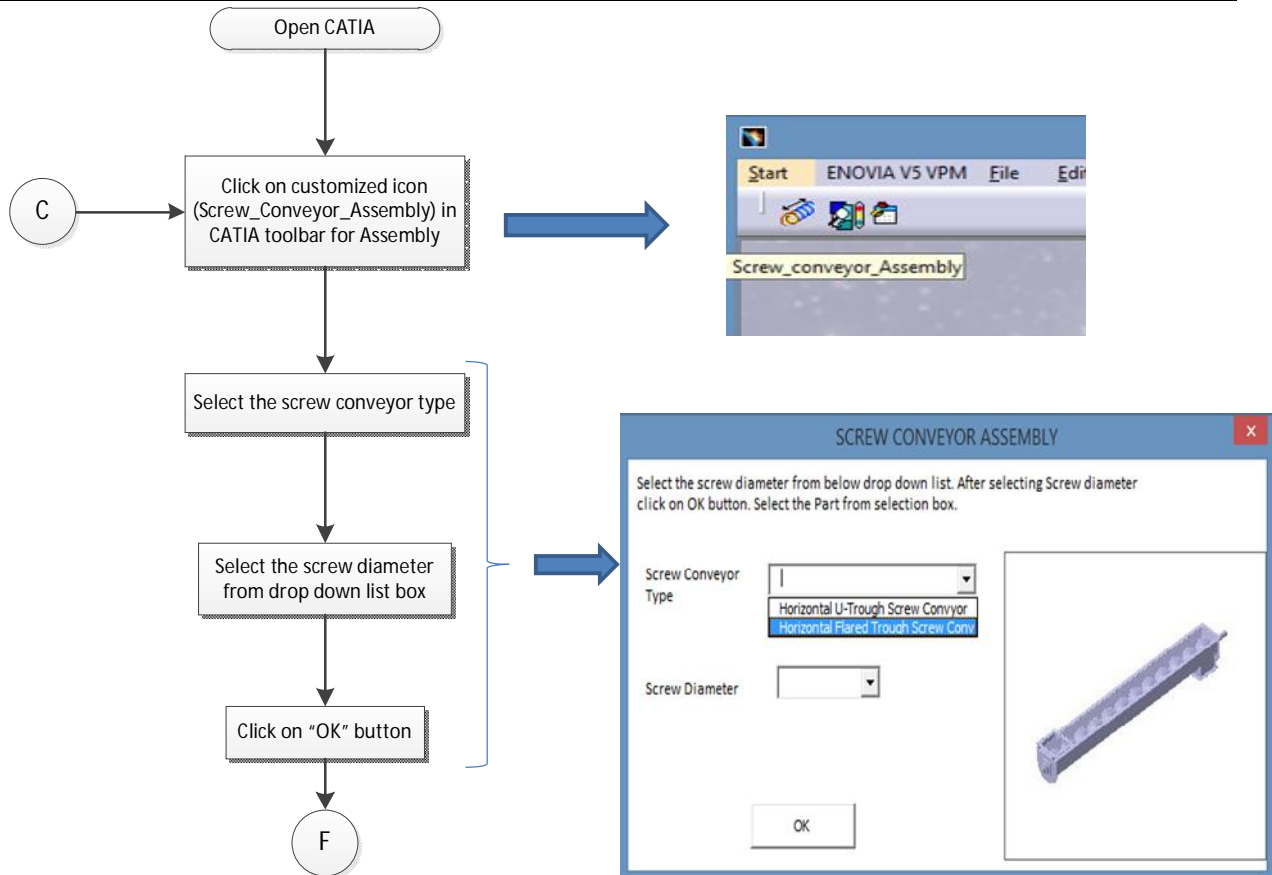
includes user interface, knowledge base, database, inference engine and CAD software. Cukovics s. et al. [2] developed automatic determination of grinding tool profile for helical surfaces machining by using CATIA/ VB interface. Shah D. B. [3] developed an automated 3D model of flange coupling. If the coupling parameters are changed the solid model of coupling change. Shah integrates the Autodesk Inventor (3D modeling software) with Microsoft Excel spreadsheet. Wayzode N.D. et al. [4] customized CATIA-V5 for design of flange coupling. For the

customization of CATIA-V5, they used CATScript as programming language. Laudanski M. et al. [5] presented automation process possibilities in CATIA-V5. They had written the code in VBA editor of CATIA-V5 for automatic creation of mould tool model. Zhongyi S. et al. [6] developed knowledge base system for composite component design by using VB.NET. They explained theory, design method and implementation method of knowledge base system for composite component design. They integrate the developed system with CATIA. Hussein H. M. A. [7] constructed a knowledge base system for sheet metal blanking dies. This system was built in CATIA-V5. The programming language used to customize the CATIA is Visual Basic. To make parametric modeling of irregular shaped objects like jewelry with parametric CAD systems is difficult. Gulati V. [8] created parametric jewelry modeling in AutoCAD by using VBA. Trivedi R. D. et al. [9] developed 3D parametric modeling of inner ring of spherical roller bearing by using integration of Pro/E and Microsoft Excel sheet. Chirne A. et al. [10] developed integrated tool for strain extraction in aircraft structure. The integrated tool has been developed by using Abaqus-Python, CATIA-VB and Visual Basic. This tool is used for identifying location, direction and strains in the strain gages of aircraft structure. Sundar S. et al. [11] developed algorithm for automated assembly of mechanical joint and create macros in CATIA-V5 for automation assembly. Kumbhar R. et al. [12] customized CATIA-V5 for creation of different types of holes on disc wheel by using VBA. Ziethen D. R. [13] in his book "CATIA-V5: Macros Programming with Visual Basic Script" explain basics of macro creation, execution, wireframe geometry, solids, surface geometry etc. Fonseca D. J. et al. [14] developed a knowledge base system for selection of conveyor equipment.

They created expert system for identify the suitable conveyor from three categories of conveyors (unit, bulk and sortation conveyors) with 76 types of conveyor by simply entering the conveyor attributes. Frunchtbaum J. [15] in his book "Bulk Materials handling" of chapter screw conveyors explain the screw conveyor component types i.e. screw type, flighting type, trough type, end plate type, screw pitch types etc. Conveyor engineering and manufacturing company [16] developed a catalogue for screw conveyor design.

3. Methodology for assembly automation

The customization of CATIA is done by two methods- In process and Out process. In process consist of three programming languages like VBA, CATScript and VBScript. But out of these VBA is best because it has debugging facility and higher user interface. The methodology adopted for automated assembly of screw conveyor component by using In process VBA language is shown in fig. 1. First click on the customized icon in CATIA toolbar. After clicking on the customized icon screw conveyor assembly user form is visualized. In the visualization form select type of screw conveyor (Horizontal U- Trough screw conveyor or Horizontal flared trough screw conveyor) and screw diameter. Then click on 'OK' button. After clicking on 'OK' button the component selection box is visualize. As per the box name select proper component & click on 'Open' button. The whole assembly of screw conveyor is generated. If we have to create another assembly of screw conveyor component having different size, then again click on customized icon and go through steps explain as above. The final assembly of two different types (Horizontal U- Trough screw conveyor or Horizontal flared trough screw conveyor) is shown in fig. 2.



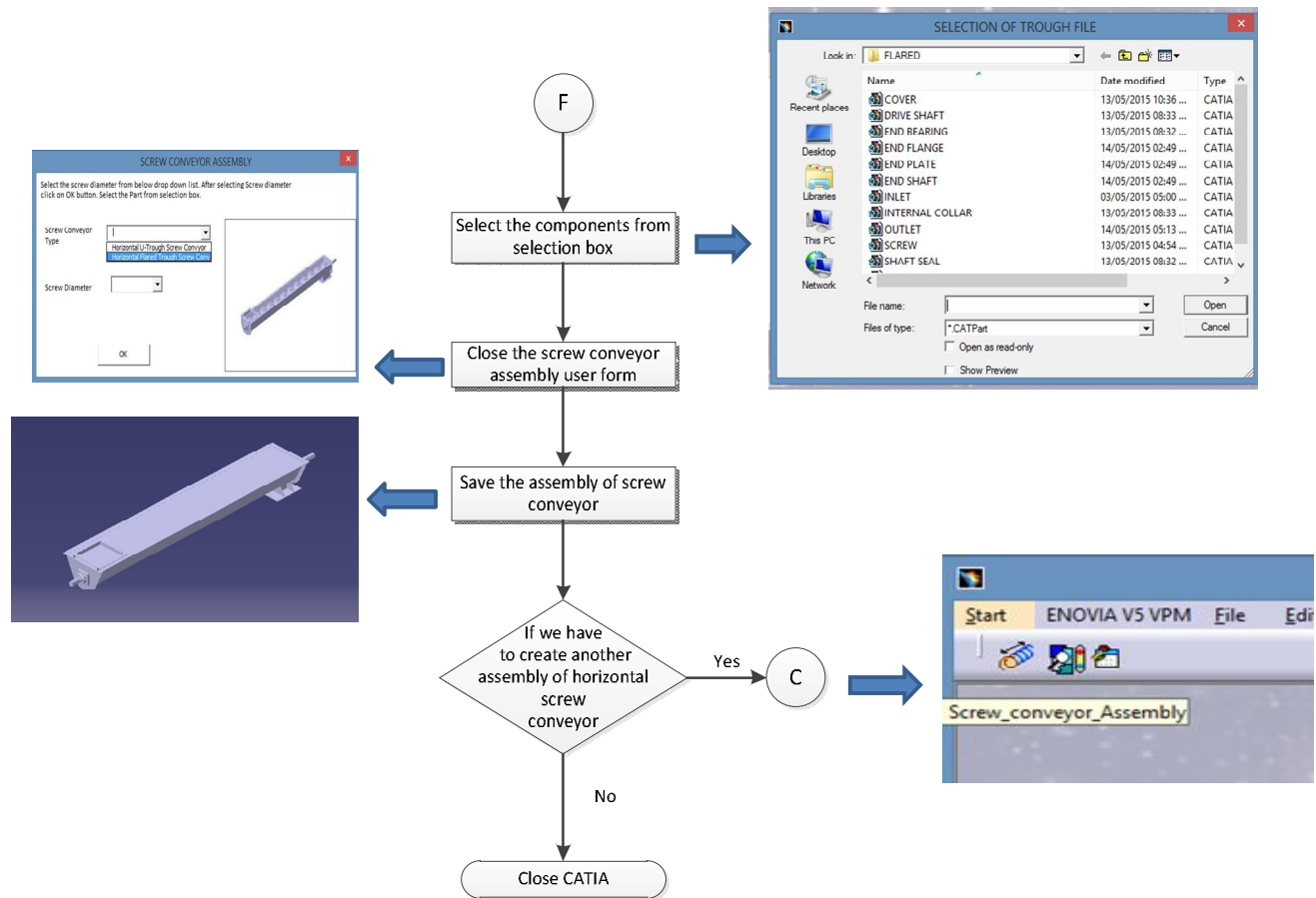
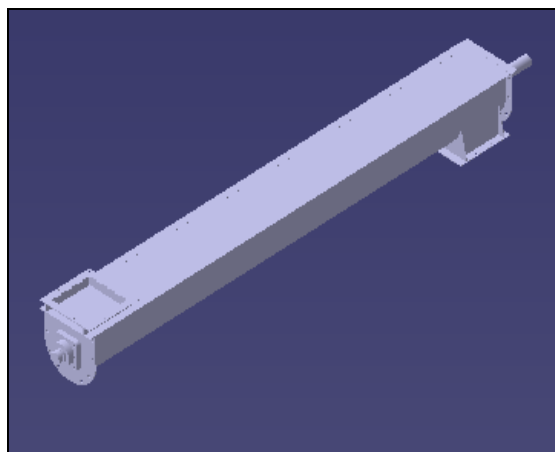
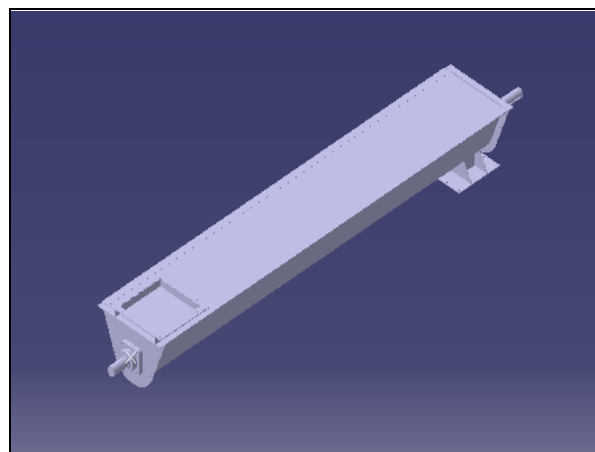


Figure 1. Flowchart for automated assembly of screw conveyor components



a) Horizontal U-Trough Screw Conveyor



b) Horizontal Flared-Trough Screw Conveyor

Fig. 2 Screw conveyor model

Table 1 Time comparison for assembly of screw conveyor components

Sr. No.	Name	Time (min:sec)			% of time saving by new user	% of time saving medium user
		Manually		Automati on		
		New user	Medium user			
1.	Assembly	62:04	25:52	02:18	96.29	91.11

4. Conclusion

The time required to generate assembly of horizontal screw conveyor component is reduced by using VBA scripting in CATIA- V5 i.e. approximately 80-90%. With the help of developed system we can generate 48 and more (like hands of flighting, pitch type of screw conveyor) screw component assembly.

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